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SCANNING ELECTRON MICROSCOPIC EVALUATION OF SEVERAL RESHARPENIN--ETC(U)  
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→ abrasive impregnated, felt wheel on the lateral surface of the blade. ↗

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Scanning electron microscopic evaluation  
of several resharpener techniques

by

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Scanning electron microscopic evaluation  
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## ABSTRACT

The scanning electron microscope (SEM) was used to evaluate the cutting edges of curettes as they came from the manufacturer, after they had been made dull and after they were resharpened by several standard resharpening techniques and one experimental technique. Micrographs were taken of the cutting edges with the SEM at a standard magnification. The quality of the cutting edges were blindly evaluated by five independent examiners who unanimously agreed that the experimental resharpening technique produced the highest quality edge. The experimental resharpening technique used a Whittler Instrument Sharpener on the face of the blade followed by a rotating, abrasive impregnated, felt wheel on the lateral surface of the blade.

## INTRODUCTION

The care of cutting edges has long been of great interest to dentists, especially those who treat the exposed root surfaces associated with periodontal disease.<sup>1,2</sup> It is generally thought that treatment of these exposed root surfaces should consist of two phases; first, the removal of plaque, calculus and necrotic and/or diseased cementum, and secondly, the creation of the smoothest possible surface on the treated root surface.<sup>3-7</sup> The smoothness of the cutting edges of the instruments used in the final phase of this treatment would seem to be critical, as smoother cutting edges would seem more likely to produce a smoother treated root surface. With renewed emphasis toward root preparation in maintenance therapy and new attachment procedures, the quality of the cutting edges of hand instruments, especially curettes, has gained increased significance.

This investigation used the scanning electron microscope to evaluate the cutting edge of curettes as they came from the manufacturer, after they were made dull and after they were resharpener by several resharpener techniques.

## MATERIALS AND METHODS

Twenty-eight new, double-ended 17-18 curettes<sup>\*</sup> were randomly selected from stock for the study.

The right side of the cutting edge of the blade at one end of the instrument and the left side of the cutting edge of the blade at the other end were designated as test cutting edges, for a total of fifty-six test cutting edges. A small notch was made on the appropriate side of the shank of the instrument to identify each test cutting edge.

<sup>\*</sup>American Dental Mfg. Co., P.O. Box 4546, Missoula, Montana 59801

Four of the twenty-eight instruments were then randomly selected to form Group I. Nothing was done to the cutting edges of this group and they were examined as they came from the manufacturer. The remaining twenty-four instruments were made dull by passing their test cutting edges over the roots and crowns of extracted molar teeth for 250 strokes to simulate clinical use. Four of the dull instruments were then randomly selected to comprise Group II and nothing else was done to their cutting edges. The remaining twenty dull instruments were randomly divided into five groups and the test cutting edges resharpened using a specific resharpening technique for each group.

In Group III, the eight test cutting edges were resharpened using a lightly oiled stationary sharpening stone. The face of the blade was positioned toward the operator and perpendicular to the stone with the lateral surface of the blade against the stone. The instrument was then pushed away from the operator, maintaining blade-stone orientation, so that the lateral surface of the blade was ground toward the face of the blade. This action comprised one resharpening stroke. Enough strokes were used, typically ten to twelve, until the test cutting edge was judged to be sharp by the "bright light test" (reflected light-white line test) and the "fingernail test."<sup>1,2</sup> These two clinical evaluation tests were also used to determine when all other test cutting edges had been adequately resharpened.

The eight test cutting edges of Group IV were resharpened with a large, cylindrical ruby stone mounted in a slow-speed handpiece and run at slow speed. The ruby stone was positioned on the shank end of the lateral surface of the test cutting edge so that the long axis of the



stone was slowly moved down the lateral surface of the blade toward the tip, maintaining blade-stone orientation along the way. This action comprised of one stroke. Enough strokes were used, typically five or six, until the test cutting edge was judged to be sharp.

The test cutting edges of Group V were resharpened with a Whittler Instrument Sharpener (WIS)\*\*. The WIS was placed at the shank end of the face of the blade with full contact between the WIS and the face of the blade. The WIS was then "rubbed" or "wiped" down the face toward the tip of the blade, maintaining full contact between the WIS and the face. This action comprised of one stroke. Enough strokes were used, typically five or six, until the test cutting edge was judged to be sharp.

In Group VI, the test cutting edges were resharpened with a rotating, abrasive impregnated, felt wheel. With the face of the blade up, the lateral surface of the test cutting edge was placed against the felt wheel as the wheel rotated in a counterclockwise direction. The edge of the instrument was slowly turned into the rotating wheel until a small curl of abrasive appeared on the face of the blade next to the test cutting edge. This procedure was repeated, typically two or three times, until the instrument was judged to be sharp.

The test cutting edges of Group VII were resharpened by first using the WIS on the face of the blade, as in Group V, followed by the rotating, abrasive impregnated, felt wheel on the lateral surface, as in Group VI.

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\*\* Whittler Instrument Sharpener, Darby Dental Co., 100 Banks Ave.  
Rockville Center, NY 11571

All resharpener procedures to the test cutting edges were done by the same investigator (DJD), with meticulous adherence to technique. Next, the blades of the instruments were cut off, mounted on stubs and photographed with a scanning electron microscope<sup>\*\*\*</sup> using a voltage of 20kV. A representative micrograph was taken in the center portion of each test cutting edge at a magnification of 250 times. This magnification was chosen as it best revealed sufficient edge detail while still showing a reasonable length of the test cutting edge. The fifty-six micrographs were randomly distributed and five board certified periodontists, who knew nothing of the study, were asked to grade the quality of the cutting edges in the various micrographs. A good quality cutting edge was defined as one in which a distinct, continuous, well-defined line angle was formed by the junction of the lateral surface and the face of the blade. The face and edge of the instrument were labeled "F" and "E" respectively to orient the evaluators. A grading system of 1 to 3 was used, with 1 indicating the best quality edge, 3 the poorest and 2 an intermediate rating.

#### RESULTS

Analysis of the evaluators scores indicated that all five evaluators rated Group VII (the combination of the WIS and the rotating, abrasive impregnated, felt wheel) as the finest quality edge. The evaluators were also unanimous in rating Group II (the dull edge) as the poorest quality edge. Group V (the WIS only) was rated next to last by four of five evaluators. Group VI (the abrasive impregnated felt wheel alone) was ranked third best by four of the evaluators and second

<sup>\*\*\*</sup>1000-A, Advanced Metal Research Corporation, 1960 Middlesex Turnpike, Bedford, MA 01730

best by the fifth. No other consistent findings were noted among the evaluators scores.

The fifty-six micrographs were then re-arranged according to groups and evaluated by the investigators. The edges in all groups demonstrated consistent findings. In Group I (the factor edge), functional wire edges were consistently seen pushed over onto the face of the blade (Fig 1). Group II (the dull edge) had a large facet or third surface created between the face and the lateral surface of the blade (Fig 2). In Group III (stationary stone used on the lateral surface), functional wire edges were consistently seen pushed over onto the face of the blade (Fig 3). The edges of Group IV (rotating stone used on the lateral surface) also showed functional wire edges pushed over onto the face of the blade. In Group V (the Whittler Instrument Sharpener used on the face), nonfunctional wire edges were constantly seen pushed over onto the later surface (Fig 5). The edges of Group VI (the rotating, abrasive impregnated, felt wheel used on the lateral surface) demonstrated a good edge with minimal wire edges pushed over onto the face of the blade (Fig 6). In Group VII (the WIS on the face of the blade followed by the rotating, abrasive impregnated, felt wheel on the lateral surface), an excellent edge consisting of a distinct, continuous, well-defined line angle created by the exact meeting of the face and lateral surface of the blade was consistently seen (Fig 7).

#### DISCUSSION

The importance of the quality of the cutting edges of periodontal instruments is well recognized.<sup>1,2</sup> A high-quality edge is generally thought to be a well-defined, sharp, continuous line angle formed by

two contiguous surfaces.<sup>1,2</sup> In the present study, all five evaluators judged the cutting edges produced by the combination of the WIS used on the face of the blade followed by the rotating, abrasive impregnated, felt wheel on the lateral surface to be the highest quality edge. This resharpening technique consistently produced excellent cutting edges which were uniformly sharp, smooth line angles free of edge irregularities. The fine, smooth edges of the curettes resharpened with this technique would seem more likely to produce smoother treated root surfaces than instruments with rough, irregular edges.

This study showed that curettes resharpened by using a WIS on the face of the blade followed by a rotating, abrasive impregnated, felt wheel on the lateral surface consistently had a very high quality cutting edge. These excellent edges seem more likely to produce a smoother surface on treated root surfaces. Additional studies are planned to evaluate this supposition.

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## CAPTIONS

### Fig. 1.

Representative edge of Group I, the factory edge. Note the functional wire edges pushed over onto the face (F) of the blade.

### Fig. 2.

Typical edge seen in Group II, the dull edge. Note the creation of a third surface between the face (F) and the lateral surface (L) of the blade.

### Fig. 3.

Representative finding in Group III, resharpened with a stationary stone against the lateral surface (L). Note the functional wire edges pushed over onto the face (F) of the blade.

### Fig. 4.

Normal findings for the edges of Group IV, resharpened with a large, rotating, cylindrical ruby stone applied to the lateral surface (L) of the blade. Again, functional wire edges are seen.

### Fig 5.

Representative edge of Group V, resharpened using a Whittler Instrument Sharpener on the face (F) of the blade. Note the non-functional wire edges pushed over onto the lateral aspect (L) of the blade.

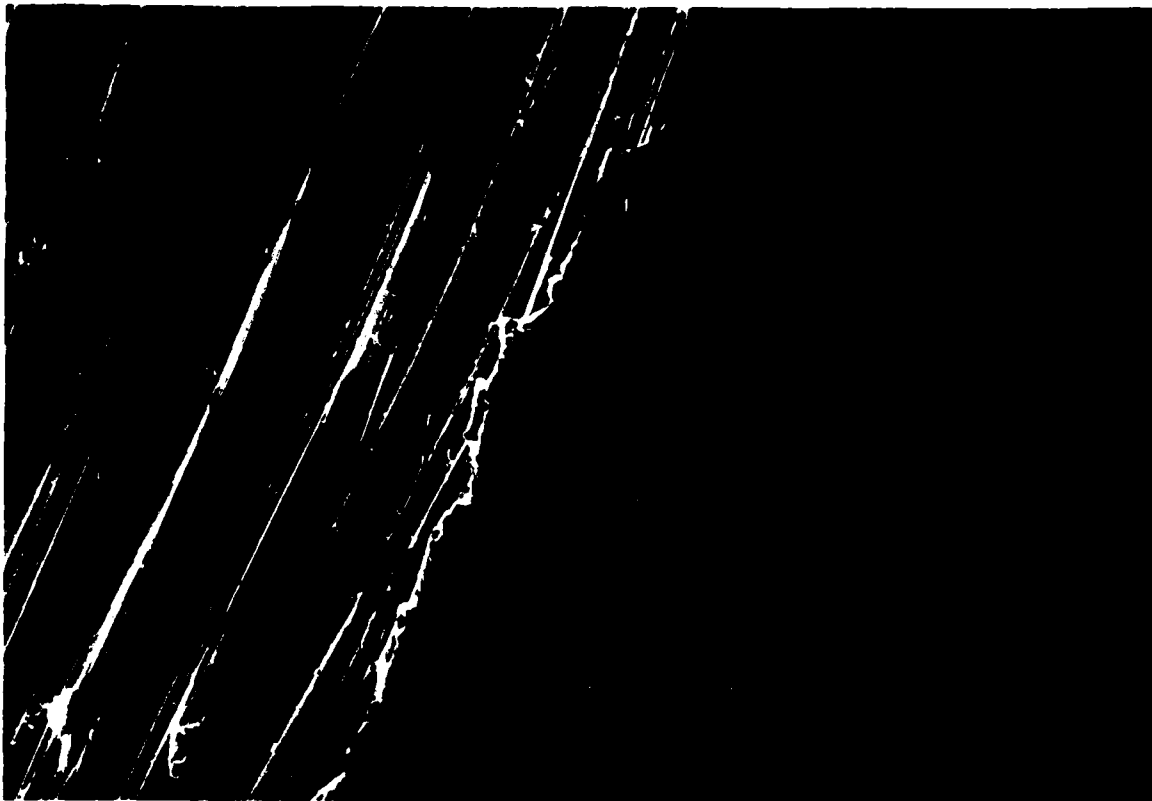
### Fig. 6.

Typical edge produced in Group VI, resharpened using a rotating,

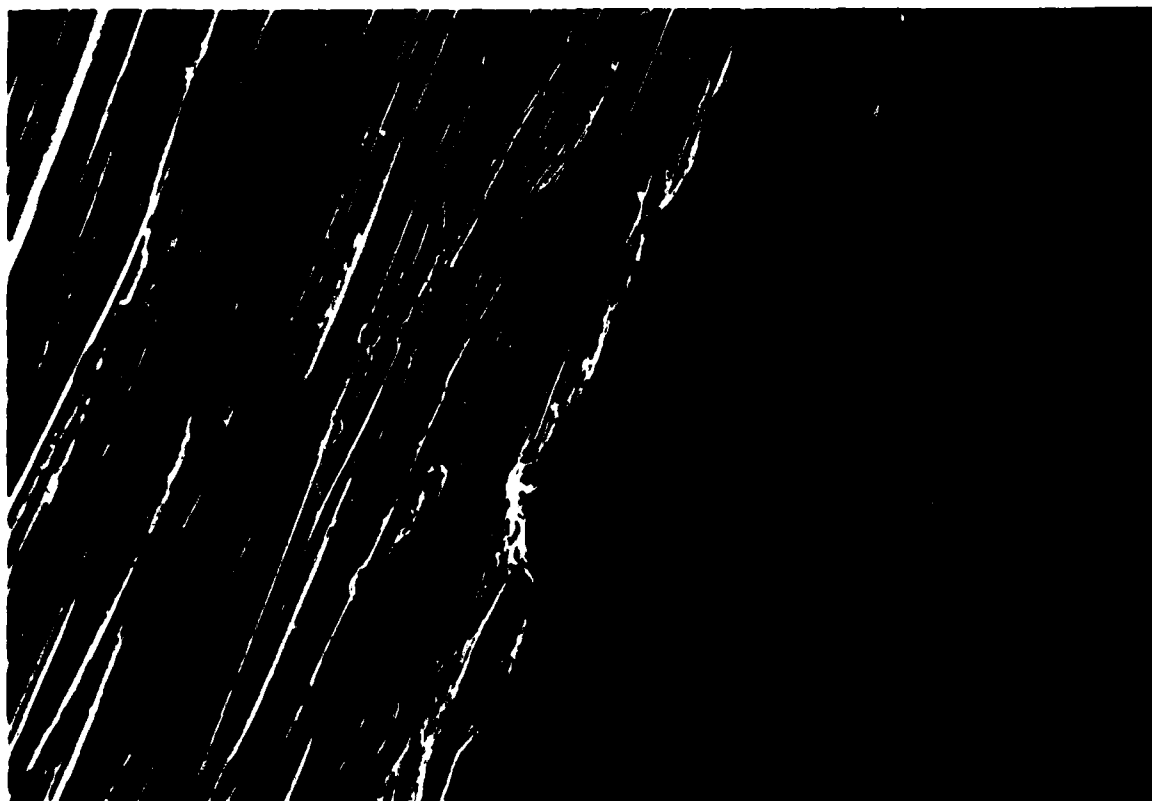
abrasive impregnated, felt wheel on the lateral surface (L). Note some small functional wire edges pushed over onto the face (F) of the blade.

Fig. 7.

Typical edge produced in Group VII, resharpened using the Whittler Instrument Sharpener on the face (F) followed by the rotating, abrasive impregnated, felt wheel on the lateral surface (L) of the blade. Note the smooth, continuous, well-defined line angle formed by the junction of the face (F) and lateral surface (L) of the blade.



F-1



F-2



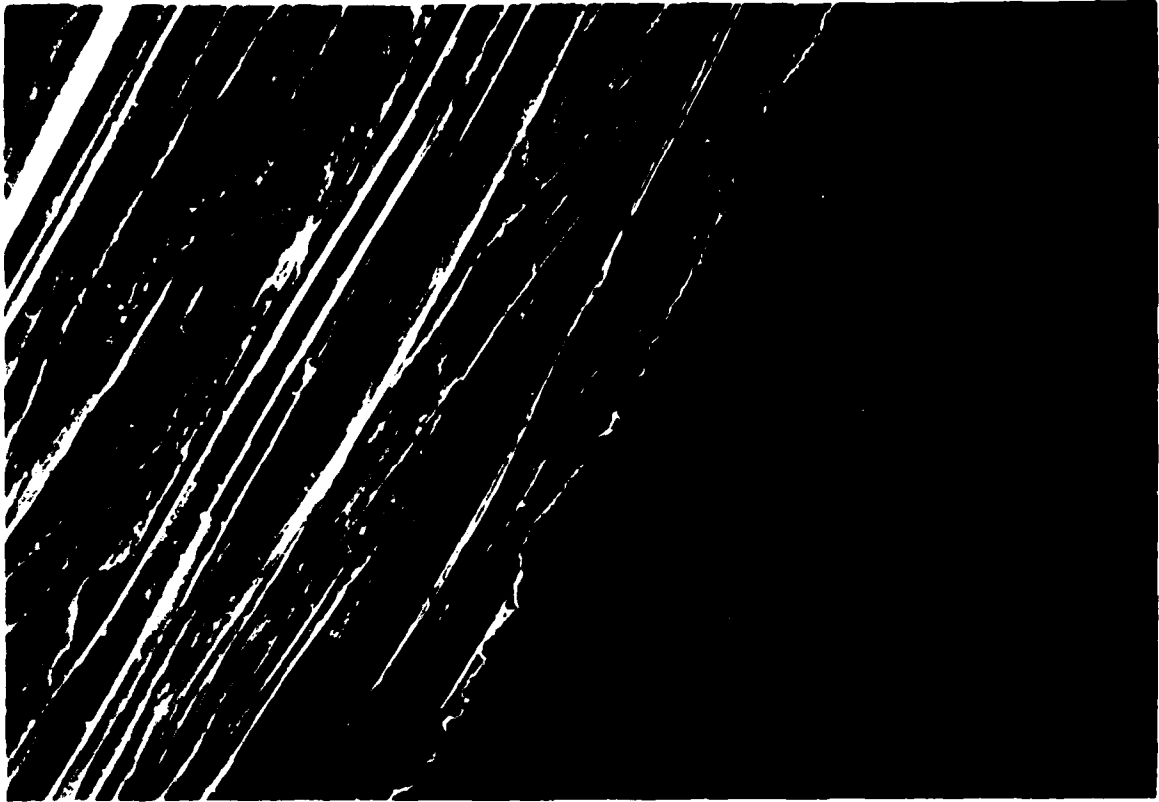


Fig. 6

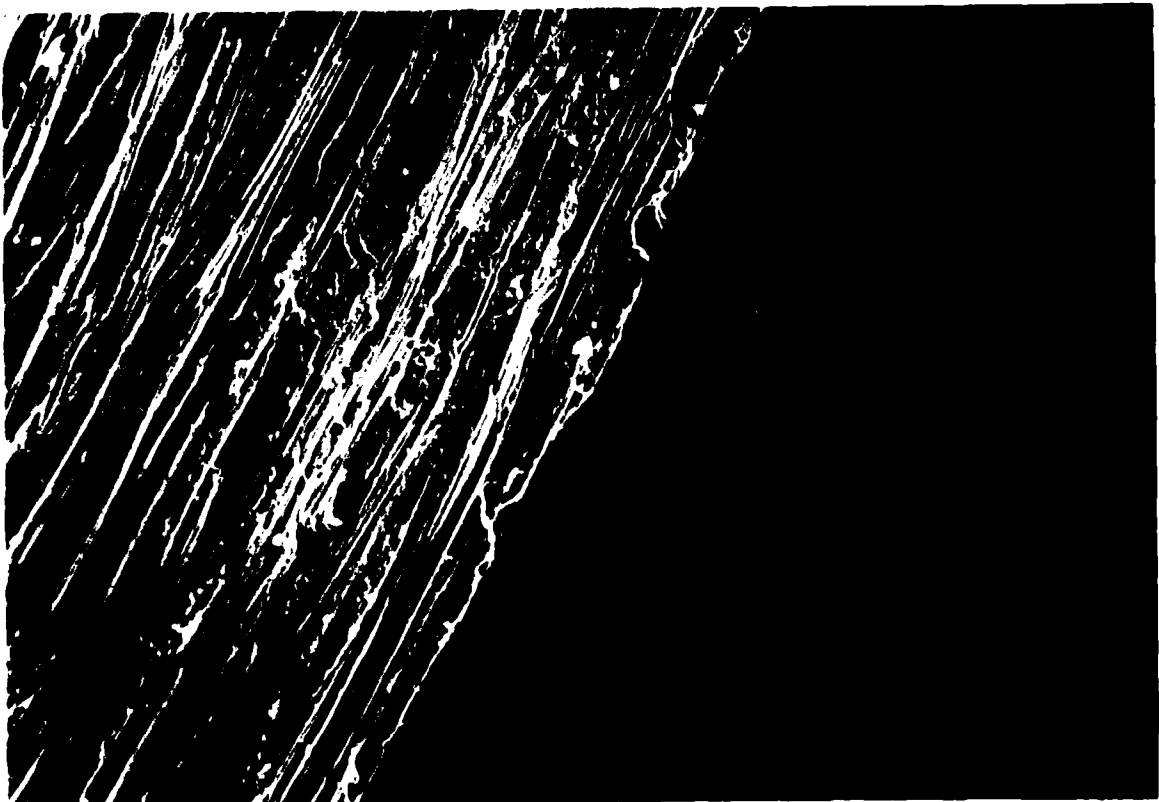


Fig. 7

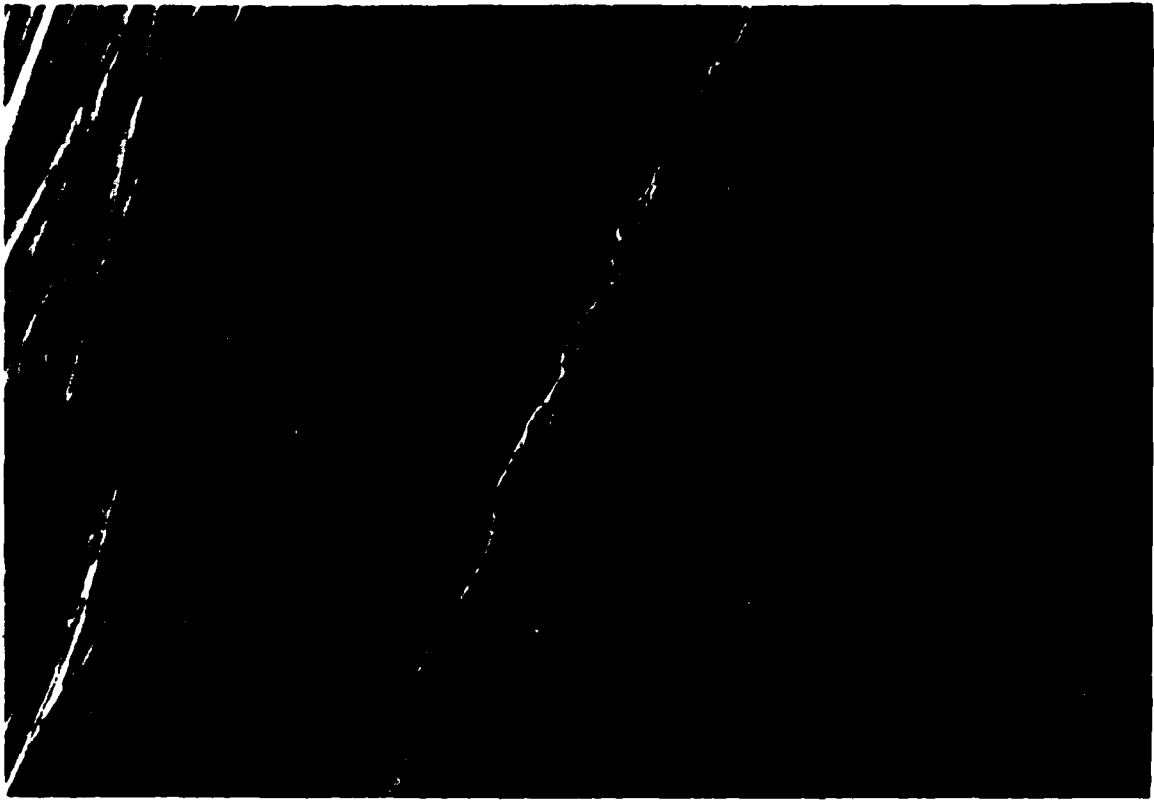


Fig 5

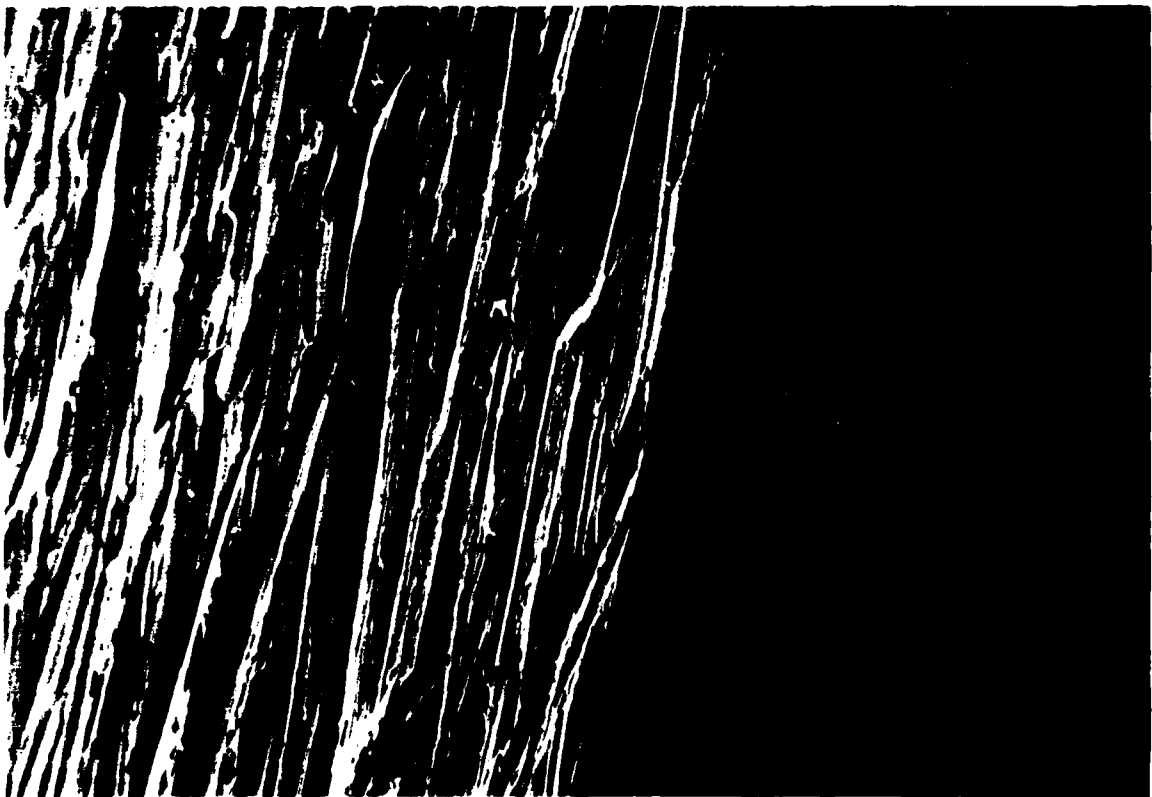


Fig 6



Fig. 7

## Bibliography

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## Disclaimer

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